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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/056,611	01/24/2002	Shiro Sakai	08228/020001	9496

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EXAMINER
NGUYEN, THANH T

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 08/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/056,611	SAKAI, SHIRO	
	Examiner	Art Unit	
	Thanh T. Nguyen	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 May 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3-14* is/are pending in the application.

4a) Of the above claim(s) *10-14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3-9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *14* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Information Disclosure Statement

The information disclosure statement filed on 5/22/03 has been considered.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 3-4, 6 are rejected under 35 U.S.C. 102(e) as being anticipated by Shin (U.S. Patent No. 6,242,328).

Referring to figures, Shin teaches a method for manufacturing a GaN compound semiconductor element, comprising the steps of:

Forming, on a substrate (1), an N type GaN compound semiconductor layer (4) and a GaN compound semiconductor layer (6) which includes a P type impurity,

Irradiating electromagnetic radiation (see col. 3, lines 61-67) of a predetermined wavelength onto the GaN compound semiconductor layer which includes a P type impurity, and

Activating the P type impurity by applying thermal energy which is approximately 400-500°C to the P type impurity in a atmosphere of normal air while irradiating the GaN compound semiconductor layer (see col. 2, lines 21-30, and claim 1).

Regarding to claim 4, forming a buffer layer (2) on the substrate (1)

Forming an N-type GaN compound semiconductor layer (4) on the buffer layer,

Forming the GaN compound semiconductor layer (6) which includes a p type impurity on the N type GaN compound semiconductor layer.

In regarding claims 6, forming a buffer layer (2) on the substrate (1), forming an P type Mg-doped GaN compound semiconductor layer (6) on the buffer layer (2).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shin (U.S. Patent No. 6,242,328). in view of Tsai et al. (US Patent No. 6,429,102).

Referring to figures 1-8, Shin teaches a method for manufacturing a GaN compound semiconductor element, comprising the steps of:

Forming, on a substrate (1), an N type GaN compound semiconductor layer (4) and a GaN compound semiconductor layer (6) which includes a P type impurity,

Irradiating electromagnetic radiation (see col. 3, lines 61-67) of a predetermined wavelength onto the GaN compound semiconductor layer which includes a P type impurity, and

Activating the P type impurity by applying thermal energy which is approximately 400-500°C to the P type impurity in a atmosphere of normal air while irradiating the GaN compound semiconductor layer (see col. 2, lines 21-30, and claim 1).

Regarding to claim 4, forming a buffer layer (2) on the substrate (1)

Forming an N-type GaN compound semiconductor layer (4) on the buffer layer,

Forming the GaN compound semiconductor layer (6) which includes a p type impurity on the N type GaN compound semiconductor layer.

In regarding claims 6, forming a buffer layer (2) on the substrate (1), forming an P type Mg-doped GaN compound semiconductor layer (6) on the buffer layer (2).

However, Shin does not teach forming the N type GaN compound semiconductor layer on the GaN compound semiconductor layer which includes a P type impurity, the electromagnetic radiation having a wavelength of 4.5 micrometer is irradiated with an intensity of 0.01 mW/mm^2 or greater, frequency of 2.45 GHz is irradiated at an intensity of $1mW/cm^2$ or greater.

Tsai et al. discloses a method of manufacturing a GaN compound semiconductor element, which includes:

a) forming, on a substrate (22, see col. 4, lines 60-61 and figure 4), an N type GaN compound semiconductor layer (26, col. 4, lines 60-67) and a GaN compound semiconductor layer which includes a P type impurity (30, col. 5, lines 1-2),

b) irradiating electromagnetic radiation (called microwave radiation at 2.45 GHz, 560 W, in Tsai et al. col. 5, lines 5-9) onto the GaN compound semiconductor layer which includes a P type impurity (30, col. 5, lines 1-2),

c) activating the P type impurity by applying thermal energy to the P type impurity while irradiating the GaN compound semiconductor layer (see col. 5, lines 4-5),

In regarding to claim 4, forming a buffer layer (24, see figure 4, col. 4, lines 60-67 and col. 5, lines 1-2) on the substrate (22), forming an N type GaN compound semiconductor layer (26, see figure 4, col. 4, lines 63-64) on the buffer layer (24), forming a P type GaN compound semiconductor layer (30) on the N type GaN compound semiconductor layer (26, see figure 4, col. 4, lines 60-67 and col. 5, lines 1-2),

In regarding claims 5, 6 and 9, forming a buffer layer (44, see figure 5, col. 5, lines 30-48) on the substrate (42), forming an P type Mg-doped GaN compound semiconductor layer (50, see col. 5, lines 33-35) on the buffer layer (44), forming an N type Si-doped GaN compound semiconductor layer (46, see col. 5, lines 44-46) on an P type GaN compound semiconductor layer (50),

In regarding to claims 7 and 8, the electromagnetic radiation having a wavelength greater than 4.5 um (0.122m, microwave at 2.45GHz) and an intensity greater than 0.01mw/mm^2 ($3.5x10^8$ mw/mm^2 with 560W at 4um^2 thick N or P type GaN layer, see col. 4, lines 63 and col. 5, lines 33-38).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form the N type GaN compound semiconductor layer on the GaN compound semiconductor layer which includes a P type impurity, the electromagnetic radiation having a wavelength of 4.5 micrometer is irradiated with an intensity of 0.01 mW/mm^2 or greater, frequency of 2.45 GHz is irradiated at an intensity of $1mW/cm^2$ or greater in process of Shin as taught by Tsai et al. because the process would a low resistivity compound semiconductor material

The specific temperature rang in claim 1 is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In re Aller *105 USPQ233, 255 (CCPA 1955)*, the selection of reaction parameters such as temperature and concentration would have been obvious:

> "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."
> *In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).*
> Therefore, one of ordinary skill in the requisite art at the time the invention was made

would have used any temperature range suitable to the method in process of Shin in order to optimize the process.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (703) 308-9439, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, can be reached on (703) 308-4940. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (**See MPEP 203.08**).

Thanh Nguyen
Patent Examiner
Patent Examining Group 2800

TTN